

Claims

What is claimed is:

1. Method for determining the glucose concentration in a body fluid, in particular tissue fluid, in which perfusate containing glucose is passed through a microdialysis probe (10) inserted into the body fluid and dialysate obtained in this process is transported to a measuring cell (16), and in which measurement signals that correlate with the glucose content of the dialysate are measured at the measuring cell (16), **characterized in that** the starting content of glucose in the perfusate is adjusted to the glucose content of the body fluid by means of a control device (18, 20) in accordance with a command variable derived from the measurement signals of the measuring cell (16).
2. Method as claimed in claim 1, **characterized in that** when the control deviation is negligible the momentary starting content of the glucose in the perfusate is determined as a measure for the glucose content of the body fluid.
3. Method as claimed in claims 1 or 2, **characterized in that** the starting content of glucose in the perfusate is determined from the adjusting variable of an adjuster (20) of the control device (18, 20).

4. Method as claimed in one of the claims 1 to 3, **characterized in that** the glucose content of the perfusate is measured before it is passed into the microdialysis probe (10).
5. Method as claimed in one of the claims 1 to 4, **characterized in that** the starting content of glucose in the perfusate is influenced by flow mixing two perfusion liquids (36, 38) with different glucose concentrations provided in two separate reservoirs (32, 34).
6. Method as claimed in one of the claims 1 to 5, **characterized in that** the perfusate is passed through the microdialysis probe (10) in alternating successive transport and dialysis intervals at different flow rates, the flow rate during the transport intervals being higher than during the dialysis intervals.
7. Method as claimed in claim 6, **characterized in that** the flow rate during the transport intervals is increased to such an extent that the starting content of glucose in the perfusate during passage through the microdialysis probe (10) remains essentially constant and that during the dialysis intervals the transport is interrupted or at least the flow rate is reduced to such an extent that the glucose concentration of the dialysate approximates the glucose content of the body fluid.
8. Method as claimed in one of the claims 1 to 7, **characterized in that** the command variable is determined by integration or differentiation of the time course of the measurement signals.

9. Method as claimed in one of the claims 6 to 8, **characterized in that** the command variable is determined by qualitative detection of signal peaks in the time course of the measurement signals.
10. Method as claimed in one of the claims 6 to 9, **characterized in that** the command variable is determined by comparing the actual signal curve of the measurement signals with calibrated signal patterns deposited in a storage medium.
11. Method as claimed in one of the claims 6 to 10, **characterized in that** the command variable is determined from the peak value of the signal time course of the measurement signals during each transport interval.
12. Method as claimed in one of the claims 6 to 11, **characterized in that** the command variable can be determined according to the glucose content c of the body fluid according to the relationship

$$c = \left[\frac{S_g}{S_g \cdot (1-b) + b \cdot S_0} - 1 \right] \cdot a \cdot c_0 + c_0$$

in which S_g denotes the peak value and S_0 denotes the base line value of the signals measured during a transport interval and c_0 is the momentary starting content of glucose in the perfusate and a , b are empirically determined correction factors compensating for diffusion and mixing and remaining recovery effects during the transport interval.

13. Method as claimed in one of the claims 1 to 12, **characterized in that** the starting content of glucose in the perfusate is regulated discontinuously by a two-point control process in which the starting content of glucose in the perfusate is changed by a predetermined adjustment value when there is a control deviation.
14. Arrangement for determining the glucose concentration in a body fluid, in particular tissue fluid, comprising a microdialysis probe (10) for the diffusion exchange of glucose with surrounding body fluid, a perfusion device (12, 14) for perfusing the microdialysis probe (10) with glucose-containing perfusate to obtain dialysate and a measuring cell (16) located after the microdialysis probe (10) for detecting measurement signals that correlate with the glucose content of the dialysate, **characterized by** a control device (18, 20) which adjusts the starting content of glucose in the perfusate to the glucose content of the body fluid in accordance with a command variable derived from the measurement signals of the measuring cell (16).
15. Arrangement as claimed in claim 14, **characterized by** an evaluation unit (22) to determine the momentary starting content of glucose in the perfusate when the control deviation is negligible as a measure for the glucose content of the body fluid.

16. Arrangement as claimed in claims 14 or 15,
characterized in that the perfusion device has a perfusate store (12) and a transport unit (14) for the preferably intermittent transport of perfusate.
17. Arrangement as claimed in claim 16, **characterized in that** the perfusate store (12) has at least two separate reservoirs (32, 34) to hold perfusion liquids (36, 38) with different glucose concentrations.
18. Arrangement as claimed in claim 16 or 17,
characterized in that the perfusate store (12) has a first reservoir (32) containing a glucose-free perfusion liquid (36) and a second reservoir (34) containing a glucose-containing perfusion liquid (38).
19. Arrangement as claimed in one of the claims 14 to 18, **characterized in that** the control device has a flow mixer (20) preferably comprising a mixing valve or clock-pulsed directional control valve as an adjuster to adjust the starting content of glucose in the perfusate.
20. Arrangement as claimed in claim 19, **characterized in that** the inlet side of the flow mixer (20) is connected to at least two reservoirs (32, 34) for feeding in perfusion fluids with different glucose contents and the outlet side of the flow mixer (20) connects a perfusate tube (26) leading to the microdialysis probe (10).

21. Arrangement as claimed in one of the claims 14 to 20, **characterized in that** the control device has a digitally operated controller (18) preferably in the form of a microcontroller.
22. Arrangement for determining the glucose concentration in a body fluid, in particular tissue fluid, comprising a microdialysis probe (10) inserted into the body fluid, at least two reservoirs (32, 34) for holding perfusion liquids (36, 38) with different glucose contents, a transport unit (14) to perfuse the microdialysis probe (10) with glucose-containing perfusate to obtain dialysate and a flow-through measuring cell (16) located downstream of the microdialysis probe (10) to register measurement signals that correlate with the glucose content of the dialysate, **characterized by** a control device (18, 20) connected on the input side to the measuring cell (16) which control device has a flow mixer (20) connected on the inlet side to the reservoirs (32, 34) and on the outlet side to the microdialysis probe (10) which acts as an adjuster to regulate the starting content of glucose in the perfusate.